What is claimed is :

1. A vestigial sideband VSB receiver for receiving signals which are transmitted by being modulated in a vestigial sideband method, comprising:

a digital processing part for selecting a desired channel frequency via an antenna and converting the desired channel frequency to an intermediate frequency to digitalize a predetermined band of the intermediate frequency;

a carrier wave restoring part for extracting pilot components from a signal of the digitalized pass band to restore carrier waves;

a demodulator for separating components I and Q from the signal of the digitalized pass band and multiplying the components with a complex carrier wave, which is restored in the carrier wave restoring part, to demultiplex the components to signals I and Q of a base band; and

a symbol restoring part for restoring a transmission symbol from the signal I of the demodulated base band.

2. A VSB receiver of claim 1, wherein the digital processing part comprises:

a saw filter for passing the predetermined band of the intermediate frequency,

a digital converter for digitalizing signals which are passed through a surface acoustic wave SAW filter,

a digital matching filter for passing a band in which information from the digitalized signals exists, and

a phase divider for dividing the components I and Q from the signals which passed through the digital matching filter.

3. A vestigial sideband receiver of claim 2, wherein the SAW filter has a pass band designed widely enough to include all vestigial sideband signals of the middle frequency band.

4. A vestigial sideband receiver of claim 2, wherein the digital converter comprises:

an A/D converter for directly converting an analogue IF signal which passed through the saw filter to a digital signal by using a fixed frequency as an input clock, and

a re-sampling part for reducing errors between the signals which are digitalized in the A/D converter by using a timing error of current symbols which are restored via the base band signal processing.

5. A vestigial sideband receiver of claim 2, wherein the digital converter comprises:

an analogue mixer for converting the analogue IF signal which passed through the saw filter to a secondary analogue IF signal, and

an A/C converter for directly digitalize the secondary analogue IF signal by using VCXO as an input clock.

6. A vestigial sideband receiver of claim 1, wherein the carrier wave restoring part comprises:

a pilot extracting part for extracting pilot signals of the components I and Q from the signals of the digitalized pass band.

a multiplier for multiplying a complex carrier wave to the extracted pilot signals I and Q to convert to the base band,

a frequency/phase error detecting part for detecting frequency and phase errors from the pilot signals I and Q of the base band,

a loop filter for converting the frequency and phase errors to DC components by filtering, and

a numerical control oscillator for generating a complex carrier wave proportional to the DC components of the loop filter to output to the multiplier and the demodulator.

7. A vestigial sideband receiver of claim 6, wherein the pilot extracting part modulates an IIR low band pass filter of a lower degree to sine waves and cosine waves.

8. A vestigial sideband receiver of claim 7, wherein the IIR low band pass filter is to be a primary All-pole IIR filter to which following formula is applied:

$$H_r(z) = s \cdot \frac{1 - a \cdot \cos \omega_c z^{-1}}{1 - a \cdot \cos \omega_c z^{-1} + z^{-2}}$$

$$H_i(z) = s \cdot \frac{1 - a \cdot \sin \omega_c z^{-1}}{1 - a \cdot \cos \omega_c z^{-1} + z^{-2}}$$

wherein, if it is assumed that Z-conversion of the primary All Pole low band pass filter is H(z), $H_r(z)$ and $H_i(z)$

are respectively a sine wave modulation signal and a cosine wave modulation signal of H(z), ω_c is a normalised carrier wave frequency, s is a normalisation constant for making a DC gain to be 1, and a is a value for determining a 3-dB band area.

9. A vestigial sideband receiver of claim 8, wherein the primary All-pole IIR filter shares a common denominator when designing a filter for extracting pilot components of the component I and a filter for extracting pilot components of the component Q.

10. A vestigial sideband receiver of claim 7, wherein the IIR low band pass filter is to be a primary Butterworth IIR filter to which following formula is applied:

$$B_r(z) = s \cdot \frac{1 - a \cdot \cos\omega_c z^{-1}}{1 - a \cdot \cos\omega_c z^{-1} + z^{-2}}$$

$$B_i(z) = s \cdot \frac{1 - a \cdot \sin\omega_c z^{-1}}{1 - a \cdot \cos\omega_c z^{-1} + z^{-2}}$$

wherein, if it is assumed that Z-conversion of the primary Butterworth IIR filter is B(z), $B_r(z)$ and $B_i(z)$ are respectively a sine wave modulation signal and a cosine wave modulation signal of B(z), ω_c is a normalised carrier wave frequency, s is a normalisation constant for making a DC gain to be 1, a is a value for determining a 3-dB band area.

11. A vestigial sideband receiver of claim 10, wherein the primary Butterworth IIR filter shares a common denominator

when designing a filter for extracting pilot components of the component I and a filter for extracting pilot components of the component Q.

12. A vestigial sideband receiver of claim 6, wherein the frequency/phase error detecting part comprises:

a code detector for detecting codes of pilot signal I which is output from the multiplier,

a delay for delaying the detected code components for N sampling, and

a multiplier for multiplying an output from the delay with pilot signal Q which is output from the multiplier to output to the loop filter.

13. An apparatus for restoring carrier waves of a vestigial sideband receiver for restoring carrier waves by receiving signals which are transmitted by being modulated in a vestigial sideband method and converting the signals to digital signals of a pass band, comprising:

a pilot extracting part for extracting pilot signals of components I and Q from signals of the digitalized pass band;

a multiplier for multiplying a complex carrier wave to the extracted pilot signals I and Q to convert them to a base band;

a frequency/phase error detecting part for detecting frequency and phase errors from the pilot signals I and Q of the base band;

a loop filter for converting the frequency and phase

errors to a DC component by filtering; and

a numerical control oscillator for generating a complex carrier wave proportional to the DC components of the loop filter to output to the multiplier and the demodulator.

14. A carrier wave restoring apparatus of claim 13, wherein the pilot extracting part vestigial sideband receiver modulates an IIR low band pass filter of a lower degree to sine waves and cosine waves.

15. A carrier wave restoring apparatus of claim 14, wherein the IIR low band pass filter is to be a primary All-pole IIR filter to which following formula is applied:

$$H_r(z) = s \cdot \frac{1 - a \cdot \cos\omega_c z^{-1}}{1 - a \cdot \cos\omega_c z^{-1} + z^{-2}}$$

$$H_i(z) = s \cdot \frac{1 - a \cdot \sin\omega_c z^{-1}}{1 - a \cdot \cos\omega_c z^{-1} + z^{-2}}$$

wherein, if it is assumed that Z-conversion of the primary All Pole low band pass filter is H(z), $H_r(z)$ and $H_i(z)$ are respectively a sine wave modulation signal and a cosine wave modulation signal of H(z), ω_c is a normalised carrier wave frequency, s is a normalisation constant for making a DC gain to be 1, and a is a value for determining a 3-dB band area.

16. A carrier wave restoring apparatus of claim 14, wherein the IIR low band pass filter is to be a primary

Butterworth IIR filter to which following formula is applied:

$$B_r(z) = s \cdot \frac{1 - a \cdot \cos\omega_c z^{-1}}{1 - a \cdot \cos\omega_c z^{-1} + z^{-2}}$$

$$B_i(z) = s \cdot \frac{1 - a \cdot \sin\omega_c z^{-1}}{1 - a \cdot \cos\omega_c z^{-1} + z^{-2}}$$

wherein, if it is assumed that Z-conversion of the primary Butterworth IIR filter is B(z), $B_r(z)$ and $B_i(z)$ are respectively a sine wave modulation signal and a cosine wave modulation signal of B(z), ω_c is a normalised carrier wave frequency, s is a normalisation constant for making a DC gain to be 1, a is a value for determining a 3-dB band area.

17. A carrier wave restoring apparatus of claim 13, wherein the frequency/phase error detecting part comprises:

a code detector for detecting codes of pilot signal I which is output from the multiplier,

a delay for delaying the detected code components for N sampling, and

a multiplier for multiplying an output from the delay with pilot signal Q which is output from the multiplier to output to the loop filter.

18. A carrier wave restoring method of a vestigial sideband receiver which receives signals transmitted by being modulated in a vestigial sideband method, and converts the signals to digital signals of a pass band to restore carrier

waves, comprising the steps of:

(a) extracting pilot signals of components I and Q from signals of the digitalized pass band;

(b) multiplying a complex carrier wave to the extracted pilot signals I and Q to convert them to a base band;

(c) detecting part for detecting frequency and phase errors from the pilot signals I and Q of the base band;

(d) converting the frequency and phase errors to a DC component by filtering; and

(e) generating a complex carrier wave proportional to the DC components to output to step (b).

19. A carrier wave restoring method of claim 18, wherein step (a) is characterized in that an IIR low band pass filter of a lower degree is modulated to sine waves and cosine waves to extract the pilot signals of the components I and Q.

20. A carrier wave restoring method of claim 18, wherein step (c) includes the sub-steps of:

detecting codes of pilot signal I which is output from step (b),

delaying the detected code components for N sampling, and

multiplying an output from the delay step with pilot signal Q which is output from step (b) to output to step (d).